New insights into the early reaction of alkali activated slag cements

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In the recent years, there is an increasing interest to reduce the environmental impact of concrete. One of the most studied strategies is the use of Portland clinker-free cement, such as alkali-activated materials, which are obtained by mixing aluminosilicates with a highly alkaline solution. Alkali-activated slag (AAS) cements are reported to have excellent engineering properties and durability, mainly when waterglass (WG) is used as activating solution.

Previous studies have addressed the influence of the composition of the activating solution and slag, on the microstructure of AAS cements, and consequently on the composition and structure of the main hydration product (C-A-S-H) [1], [2]. Most of these studies have been performed on already hardened samples, however, very few have been focused on the first minutes of slag reaction that can affect properties such as rheology of AAS mortars and concrete.

In this study, a deep characterization of the early hydration products of WG-AAS pastes has been performed. WG-AAS pastes have been characterized from 0 to 20 minutes of hydration by different techniques such as laser diffraction, XRD, FTIR, TG-MS, SEM-EDX, nitrogen adsorption or ICP-OES. Moreover, the early hydration has been modelled using the Gibbs free energy minimization program, GEMS. Results have confirmed the formation of an initial C-A-SH, with an increasing Al content with curing time.

References

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